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Multi-channel Adaptive Filtering for Automated Processing of Seismic Data

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Automated seismic monitoring of large regions requires the development of automated data processing methods. Filtering demands are highly varied as a function of distance, event magnitude, bearing, etc. We are developing an automated method to design a filter using recorded data. Signal to noise ratio (SNR) of the power from pre and post P arrival signals is calculated for a variety of frequency ranges represented by the various scales of a wavelet transform. For single station event signals, a SNR value is calculated for each band or scale. For array signals, a median filter is applied across the array stations to calculate a SNR value for each scale. When the SNR of any band or scale exceeds the SNR of the unfiltered signal, the band is included in the reconstruction or synthesis. The results offer a significant improvement in SNR, particularly for low SNR events. Conventional methods of finding a 'generic' filter for a region are often, quite subjective and involve intensive analysis of many events. Also, to accommodate automated processing, filter parameters are overly generalized or involve complicated switching. Our method automatically calculates mean and variance filter parameters for a set of events in a region. Low variance regions offer a straightforward, optimized filter. High variance regions are filtered adaptively. The filtered signals can offer improvements in travel-time picking, bearing estimation, and event detection.

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